U.S. NAVAL BASE, PEARL HARBOR, DRY DOCK NO. 3
(U.S. Naval Base, Pearl Harbor, Naval Shipyard, Facility No. S781)
On northern shoreline of shipyard, west of Dry Dock Nos. 1 & 2, near the intersection of Avenue G and Sixth Street
Pearl Harbor
Honolulu County
Hawaii

HAER HI-67
HI-67

PHOTOGRAPHS

WRITTEN HISTORICAL AND DESCRIPTIVE DATA

HISTORIC AMERICAN ENGINEERING RECORD
PACIFIC GREAT BASIN SUPPORT OFFICE
National Park Service
U.S. Department of the Interior
1111 Jackson Street
Oakland, CA 94607

HISTORIC AMERICAN ENGINEERING RECORD

U.S. NAVAL BASE, PEARL HARBOR, DRY DOCK NO. 3
(U.S. Naval Base, Pearl Harbor, Naval Shipyard, Facility No. S781)

HAER HI-67

Location:	On northern shoreline of Shipyard, west Dry Dock Nos. 1 & 2, near the intersection of Avenue G and Sixth Street Pearl Harbor Naval Base Honolulu County Hawaii UTM: This building falls within the UTM coordinates of the Pearl Harbor Naval Shipyard as defined in the location section of the overview report HABS HI-483. The UTM coordinates for Dry Dock No. 3 are: 04.607420.2361700
Dates of Construction:	1942
Engineers:	Engineering Service Contractors, P.N.A.B. (Engineers) and F.R. Harris, Inc. (Consulting Engineers)
Builder:	Bureau of Yards and Docks, Fourteenth Naval District
Contracting Company:	Hawaiian Dredging Company, Ltd., and Pacific Bridge Company
Present Owner:	United States Navy
Present Use:	Dry Dock
Significance:	This dry dock is associated with the expansion of waterfront facilities at Pearl Harbor in the 1940s. The dock was built using a distinctive method of construction and was built under "wartime" conditions. It is the smallest of the four dry docks at Pearl harbor, built to dock destroyers and submarines.
Historian:	Lorraine M. Palumbo, Architectural Historian with Mason Architects, Inc.
Project Information:	Photo documentation and recordation of this facility by the Navy has been done in anticipation of future alterations or potential demolition of the structure. Photo documentation of historic facilities by the Navy assists in expediting planned undertakings by having the documentation prepared prior to taking actions. Also, photo documentation assists the Navy in gaining more information about its historic facilities to assist

in making proactive management decisions. This project was supervised by Jeffrey Dodge, AIA, Historic Preservation Specialist at the Pacific Division, Naval Facilities Engineering Command (NAVFAC EFD Pacific). The photographic documentation was undertaken by David Franzen, photographer. Lorraine M. Palumbo, Architectural Historian, of Mason Architects, Inc. prepared the written documentation. The field work and research was conducted for this report between January 2002 and August 2002. It was edited in 2009 by Anne Mason, HAER Collections Manager, to better comply with HAER standards

For contextual information about the early dry dock history of Pearl Harbor, refer to the overview that is included in the documentation for Dry Dock No. 1 (HAER HI-65). Dry Dock Nos. 2 and 3 were built under the same contract and, in most documents, the docks were discussed together as one project, making some duplication of information unavoidable. Please refer to the report on Dry Dock No. 3 (HAER HI-67) for more complete information on the change of contract after the war. HAER surveys for the Dry Docks Nos. 1 through 4 have been prepared and can be reviewed for additional information about the individual structures.

HAER Number	Facility Number	Report Name	Date
HAER HI-65	S779	Dry Dock No. 1	1919
HAER HI-66	S781	Dry Dock No. 2	1940
HAER HI-15	S782	Dry Dock No. 4	1943

Description:

The construction contracts of Dry Docks Nos. 2 and 3 were awarded under the same contract number NOy-3825 and were completed under contract number NOy-5049. Dry Dock No. 3, like all dry docks, is an open box which can be closed at one end, set below water level. This dock has a rounded end, like the two earlier dry docks built at Pearl Harbor. Dry Dock No. 3 is a smaller structure than the other dry docks at this installation, designed to accommodate destroyers and submarines. It measures 487' x 84', and a 22' depth from top to sill. Like the adjacent Dry Dock No. 2, Dry Dock No. 3 was built with reinforced concrete supported on steel-pile foundations. The dry dock is closed with a steel caisson-type gate. In building portions of these WWII docks, the tremie[1] method of placing concrete under water was used, because it was faster than the steel cofferdam method used in the 1910s, for the construction of Dock No. 1.[2] The tremie process is utilized for under water construction and involves dropping concrete through a tremie, a pipe or tube with a funnel shaped (hopper) piece at the top. The hopper piece acts as a receptacle to deliver the concrete.

The basic design of Dry Dock No. 3, like all dry docks, required its weight to be greater than the water it displaced; plus the sides and bottom of the box had to be designed as beams or slabs that

[1] A tremie is "an apparatus for depositing and consolidating concrete under water," as defined in http://www.wordwebonline.com/en/TREMIE, accessed 21 May 2009
[2] U.S. Navy, Bureau of Yards and Docks, 1947: 124

could withstand the hydrostatic pressure from below and the lateral pressure on the side walls. The basic construction steps for Dry Dock No. 3 included placing a gravel foundation bed, driving steel piles, placing tremie truss floor units, and pouring the tremie concrete floor. Then "a closure cofferdam was built at the entrance to the dock, and steel sheet piling was placed to form the outer form wall for the built, and the concrete" walls were poured in the dry.[3] This method of building the sidewalls was feasible for Dry Dock No. 3 because it had a shallow depth, compared to Dry Dock No. 2.[4]

The Pacific Bridge Company submitted two contract completion reports, each titled "Technical Report and Project History." One report described the work under contract number NOy-3825 and the other NOy-5049. Contract NOy-3825 originally covered the construction of Dry Dock Nos. 2 and 3; however, this contract was terminated on December 7, 1941, and the work of the completion of the dry docks was placed under the newer contract (NOy-5049). The reason for the switch was because under wartime conditions, the Navy desired to have the flexible control that cost-plus-fixed-fee (CPFF) contracts allowed. The NOy-3825 contract was a lump-sum contract, while the NOy-5049 contract, signed in late 1941 was a CPFF arrangement.[5]

Historical Context:

The overview of the dry docks at Pearl Harbor can be viewed in the HAER reports for Dry Dock No. 1, HAER HI-65 and Dry Dock No. 2, HAER HI-66. HAER HI-66 focuses on the history of Dry Dock No. 3, especially its construction history, with emphasis on how it differed from Dry Dock No. 2.

CONTRACT NO. NOy-3825

For more information on Contract NOy-3825, see HAER HI-66 for Dry Dock No. 2; that report outlines the shared history of these two dry docks. Only specific information about Dry Dock No. 3 follows.

A. Construction History
[The following summary of the construction procedures for Dry Dock No. 3, combines work done under the original NOy-3825 and under the completion contract NOy-5049].

Preparing grade for tremie slab
Driving foundation piles
Placing tremie truss and form units
Placing tremie concrete
Steel sheet pile braced down to tremie trusses of floor
Closure cofferdam constructed at entrance end
Backfill sidewall sheet piling

Dewatering dock

[3] U.S. Navy, Bureau of Yards and Docks, 1947: 124
[4] Pacific Bridge Company, 1944: 79
[5] U.S. Navy, Bureau of Yards and Docks, 1947: 122

Interior sidewall forms then constructed of wood, using plywood interior lining
Pour concrete sidewalls
Steel bracing to sheet piling burned off
Pouring concrete floor lining and details
Completing crane track and all accessories
Constructing piles, concrete, anchorage, etc., at entrance quay walls

CONTRACT NO. NOy-5049

The following section summarizes the second report, which covered the completion of Dry Dock Nos. 2 and 3, as well as the construction of Dry Dock No. 4, power plants, moorings, and additional facilities under Contract Number NOy-5049. The report, 219 pages long, included two sections, Administrative Data and Narration, as the first report. There were 38 different projects under this single contract number. The project originally began with six projects, but several "Changes" and "Supplemental Agreements" made after the start of the war increased the number of projects substantially. Only the information relevant to Dry Dock Nos. 2 and 3 will be listed here. (Pages quoted from the report are noted after headings.)

TABLE OF ADMINISTRATIVE DATA

GENERAL p. 4-8)

Contractor:	Pacific Bridge Company 333 Kearny Street San Francisco, California
Insurance Company:	United State Fidelity and Guaranty Co. Baltimore Maryland
Plans and Specifications By:	Bureau of Yards and Docks
Mechanical and Electrical Installations for Projects 6, 10, 11, 12 and 17 by:	Harry R. Byers, Inc.
Plans for Salvage Work by:	Pacific Bridge Company and 14th Naval District
Engineering Service Contractor:	Engineering Service Contractors, P.N.A.B. Being a joint venture of Tuttle, Seelye, Plance & Raymond 101 Park Avenue, New York and Fugard, Olsen, Urbain & Neiler 520 North Michigan Avenue, Chicago

Inspection of Materials: Inspector of Navy Materials; civilian Navy inspectors, working under Officer-in-Charge of Construction

Approval of Drawings: Bureau of Yards and Docks
Resident Officer-in-Charge
Officer-in-Charge of Construction

Drawings were produced by the 14th Naval District. Pearl Harbor, T.H. Field schematic drawings of the Services & Tunnel Lighting were produced by Cory and Joslin, Inc. of San Francisco by JIL (initials).

Source of Labor: Some 70% of all labor was imported from the mainland; it was recruited from all parts of the United States but particularly from the San Francisco Bay and the Los Angeles area. Local labor was largely native Hawaiian, with some Chinese, Korean, Filipino, and Japanese. Immediately after the "blitz" on December 7, 1941, all alien Japanese and Americans of Japanese ancestry, were terminated.

TIME (p. 9)

Contract Signed: 4 October 1941
Preliminary Plans Issued: 13 November 1941
Final Plans Issued: 19 May 1942
Field Work Started: 6 November 1941
Official Notice to Proceed Issued: 23 January 1940
Field Work Terminated: 31 March 1944
Usable Completion:

Project No.	Description	Date of Usable Completion
1	Quay Wall and Pier at entrance to Dry Dock No. 2	Cancelled
2	Connecting culvert between Dry Dock Nos. 1 and 2	October 1943
3	Services in vicinity of Dry Dock Nos. 2 and 3	December 1942
8	Spare Caissons for Dry Dock Nos. 2 and 3	May 1943
28	Completion of Dry Dock Nos. 2 and 3	December 1942

Office Work Terminated: 23 May 1944
% Field Work Completed: 100%
Total Contract Time: 845 days (construction time)
Close Out Completed: 23 May 1944

NARRATION

AUTHORITY

B. Brief Description of Facility (p. 44)
The work under this contract consisted of the completion of two dry docks (Nos. 2 and 3) already under construction, the construction of another (No. 4), their appurtenances and services; construction of a marine railway (and repairs to an existing one); construction of a bombproof power plant (with substation and equipment); of two other substations and a series of switch stations throughout the area, with an interconnecting power-loop system; erection of cranes; construction, salvage operations, and other emergency work, made necessary by the Japanese "blitz" of December 7, 1941.

GENERAL

A. Design (p. 47)
1. Organization
a. Bureau: the general preliminary design for all work under NOy-50049, and the structural design for parts of projects Nos. 1 and 4 were developed by the Bureau of Yards and Docks.
b. Architect and Engineer: No architect-engineer was selected or assigned by the Bureau to design the construction under NOy-5049

B. Purpose of Contract (p. 52):
The original purpose of the contract was to equip the Pearl harbor Navy Yard with additional docking and power facilities - together with roads, utilities, and other auxiliary appurtenances; also with a quay wall, pier, and mooring facilities for aircraft carriers. Subsequently-issued change orders eliminated from the contract the three items last mentioned; added certain other projects calculated to enhance speed and effectiveness of yard operations - and provided for the salvage of certain elements of the fleet.

As an essential function in the accomplishment of this stated purpose, the contractor's San Francisco office procured, and expedited delivery of, necessary materials unobtainable in Hawaii, procured, and saw to the transportation of, labor required in excess of that available in the Islands.

TECHNICAL DISCUSSION

A. Construction History (p. 69-78)
1. Organization of the Work

It is commonplace for the field office to be separate from the "home office"; it is not commonplace when the separation includes two thousand miles of Pacific Ocean - still less so when use of that ocean is a war risk. Such conditions affected organization of the work.

The San Francisco organization included sections for engineering, purchasing, procurement of labor, expediting, shipping, accounting. On Oahu, in the Pearl Harbor Navy Yard, the field office interested itself primarily in construction; but, because of distance, time-lag in communications and war conditions, it was necessary to develop other sections; engineering, local procurement, auditing, accounting. The two latter sections worked closely with the Navy Auditor.

Under the general direction of the project manager (Pearl Harbor), general superintendents coordinated the work on the several projects, with an assistant superintendent in charge of each individual project and trade superintendents supervising the work of their respective crafts. It was possible, in the cases of certain types of work, to assign foremen, and gangs, to work a single project through continuously to completion; in certain trades, however, it was necessary to shift personnel from project to project as the work progressed.

Such local labor as could be used - and more than a million dollars worth of locally procurable materials - were procured by field-office personnel.

2. Construction Operations
As of December 7, 1941, preliminary work on the original scope (projects Nos. 1 to 6) of NOy-5049 (signed October 4, 1941) in the nature of field investigations, and planning, had been begun; also, the work of material procurement had been initiated at the mainland office, in San Francisco. Except for site clearance, including demolition of the existing buildings, started November 6, 1941; no actual construction work had been done (Excavation by dredging, for Dry Dock No. 4, had been started November 27, 1941, under NOy-4173.

[After the] "blitz," the contractors under NOy-4173 and the contractor under NOy-5049 literally pooled, combined all their resources to meet the conditions precipitated by the Japanese attack, to render maximum assistance to the Navy in emergency work. Such work took instant precedence over originally-contemplated construction operations.

Dry Dock Nos. 2 and 3 were already being constructed (by the same contractor, Pacific Bridge Company, under NOy-3825); No. 2 was nearing completion; No. 3 was half finished. An imperative was docking facilities, the return to service of ships damaged in the "blitz"; dry dock No. 2 was impressed into service before its completion.

Eventually, it was decided to terminate NOy-3825, as of December 7, 1941, and to finish its uncompleted work under NOy-5049 (as Project No. 28). Meanwhile, the contractor's equipment was employed in salvage operations (subsequently included in the contract as project No. 27).

In sum, the "blitz" affected virtually all construction operations, added unanticipated projects to NOy-5049 in such miscellany to render the projects list confusing.

[Only the discussions related to Dry Dock No. 3 are quoted below, although the contract report also includes in this section the completion work on Dry Dock No. 2 and some additional facilities for Dry Dock No. 1.]

Dry Docks Nos. 1, 2, and 3
As the work on these docks to be accomplished under NOy-5049 consisted of completion of work begun under NOy-3825, it is essential to an understanding of this completion work that the status as of December 7, 1941 be briefly reported.

As of December 7, 1941, the tremie concrete floor slab was complete, the enclosing sheet piling in place. Backfill around the dock was 95% complete.

Dry Dock No. 3 was unwatered December 23, 1941. A leak was found, on the east side, in the pumpwell section - caused by improper closure of the tremie concrete around the sheet piling and the forms imbedded in the concrete. In was necessary to flood the dock; the leak was successfully stopped (by grouting) December 30, 1941.

A memorandum of January 17, 1942 indicates that operations were so scheduled as to permit docking in Dry Dock No. 3 about March 1, 1942 - conditioned to some extent, by the movements of the gantry crane in connection with the docking of ships in Dry Dock No. 2. To follow the scheduled program required the completion of two sections of sidewall, approximately forty feet long, at the entrance end of the dock, to receive the caisson. (Simultaneously, a 60'-wide strip of finished floor, running the full length of the dock, was completed.) The construction method planned for No. 3 provided for dry pour of walls, following unwatering. Outer-wall forms were constructed of sheet-steel piling braced to floor trusses, and back-filled before unwatering. The inner-wall forms were of wood; the diagonal brace to the floor was left in place until pouring was complete, not cut off until removal of the forms. Obviously, until the walls were poured, the full width of the dock was not available for even emergency docking.

For unwatering, the dock entrance was closed by a cofferdam of sheet piling; after completion of the entrance wall-sections, the piling was burned off below the sill line. With the caisson them moved into place, the dock could have been used, limitedly, in emergency - emergency services were installed by the contractor for such use. In fact, the dock was not impressed into service until after the walls had been completed.

As soon as the caisson gate was placed in operation, wall construction proceeded, beginning with the pumpwell sections. The walls completed, the outer wall form (or cofferdam bracing) was removed, and the finished floor extended to the sidewalls. Pile driving (for crane-track girders), and construction of girders, and of capstan and bollard foundations, proceeded concurrently.

A few "construction-operations" notes applicable to Dry Dock Nos. 1, 2, and 3: All operations towards completion were to an extent handicapped by the continuing use of docks Nos. 1 and 2 for repair of salvaged ships; New work - specialized in nature - further complicated operations.

Project No. 3 added to the contract certain services in the vicinity of Dry Dock Nos. 2 and 3, including railroad connections; electrical, salt water, compressed air, and steam lines; paving; drainage. Project No. 2 was a connecting culvert between Dry Dock Nos. 1 and 2. [The rapid completion of Dry Dock No. 3 and other projects, despite the work stoppages caused by the ongoing operations in the adjacent Dry Dock No. 2 plus blackouts and other difficult working conditions, earned the contractors the Navy "E" for excellent work in the spring of 1943.]

Use of Dry Dock No. 3 during WWII

The first ship to be repaired or overhauled in Dry Dock No. 3 was in the dock by May 27, 1942.[6] Many other ships and submarines were repaired here during and after the war

Later Improvements to Dry Dock No. 3

In 1973, by MCON Project P-047, "Drydock No. 3 Improvements," Dry Dock No. 3 underwent major alterations and improvements; the utility galleries were waterproofed; the utilities were improved; and the caisson was modified.[7] Pumps were added on the caisson and the service tunnel gallery was enclosed to allow for superflooding.[8]

[6] National Archives II
[7] Pearl Harbor Naval Shipyard, 1981
[8] Borges, Paul, 1998

Sources of Information

The original drawings for this structure are digitally scanned images or microfilm at Pacific Division, Naval Facilities Engineering Command (NAVFAC EFD Pacific) Plan Files.

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